

MGA-85-A Evaluation Circuit Board

Application Note

**Applies to MGA-85563
RFIC Low Noise Amplifier**

Description

The MGA-85-A printed circuit board is designed to allow you to test and evaluate performance of the MGA-85563 RFIC amplifier for your specific application.

The MGA-85563 is a two-stage, low noise, GaAs RFIC amplifier that operates over the 800 MHz to 6 GHz frequency range. For detailed design information covering the use of the MGA-85563, refer to the Application Note included as part of the MGA-85563 data sheet. (Request HP publication 5966-3109E, *3-volt, Low Noise Amplifier for 0.8 - 6 GHz Applications.*)

The MGA-85-A circuit board is normally fabricated on 0.031-inch thick FR-4 ($\epsilon_r = 4.65$) dielectric material. (Note: Some earlier boards may be received with GETEK[®] G200D, $\epsilon_r = 4.2$, laminate.) While the MGA-85-A can be used with the MGA-85563 amplifier for frequencies up to 6 GHz, this circuit board is generally not recommended for use beyond approximately 4 GHz. For higher frequency applications, such as in the 5.7 GHz ISM and license-free bands, a lower loss dielectric material such as PTFE/glass is

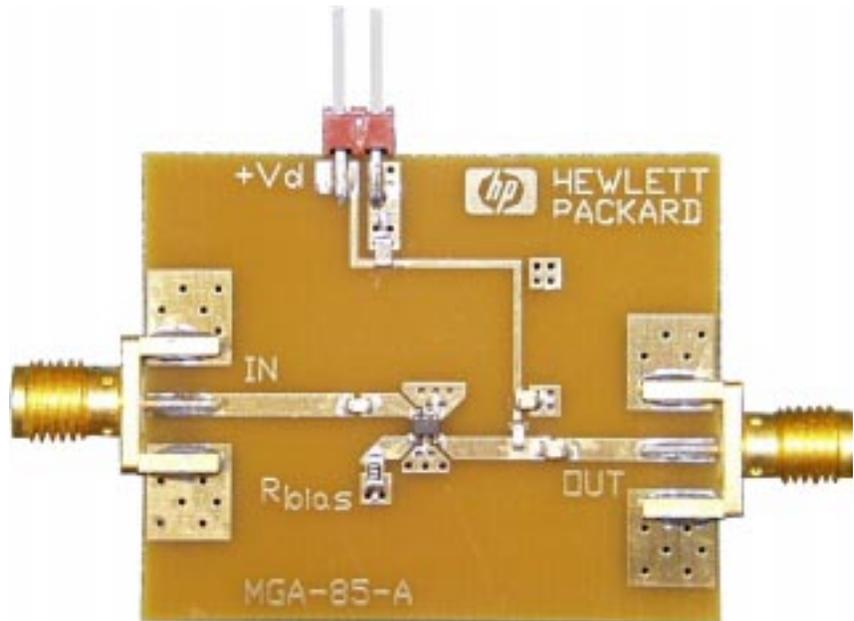


Figure 1. Photograph of MGA-85-A Evaluation Circuit

recommended to achieve lowest noise figure performance.

General Assembly Information

The amplifier and related components are assembled onto the printed circuit board as shown in the photograph in Figure 1 and in the assembly drawing in Figure 2. The MGA-85-A circuit board is designed to use edge-mounting SMA connectors such as Johnson

Components, Inc., Model 142-0701-881. These connectors are designed to slip over the edge of 0.031-inch thick circuit boards and obviate the need to mount PCBs on a metal base plate for testing. The center conductors of the connectors are soldered to the input and output microstrip lines. The ground pins are soldered to the ground plane on the back of the board and to the top ground pads. The +V_d connection and its

adjacent ground pad are designed to fit a 2-pin, 0.100" centerline single row header of the type popularly used in computing equipment (Molex, Inc. P/N 22-10-2021 or equivalent). This type of PCB-to-wire connector provides a convenient means of making connection to the power supply using either a mating connector or clip leads.

A schematic diagram of the circuit is shown in Figure 3. Values for L1 for various frequencies are listed in Table 1. The ground pad provided near the V_d connection can be used to add C4 for additional bypassing of the bias line if desired.

C1 is an optional DC blocking capacitor. No provision is made for this capacitor on the MGA-85-A board. If the amplifier is to be connected to a preceding circuit that has a DC voltage present on its output, a gap can be cut in the input 50 W line to include C1.

Operation

The MGA-85563 amplifier is a voltage-biased device. To operate, it is only necessary to apply 3 volts to the $+V_d$ connection. Typical current drain is 15 to 30 mA

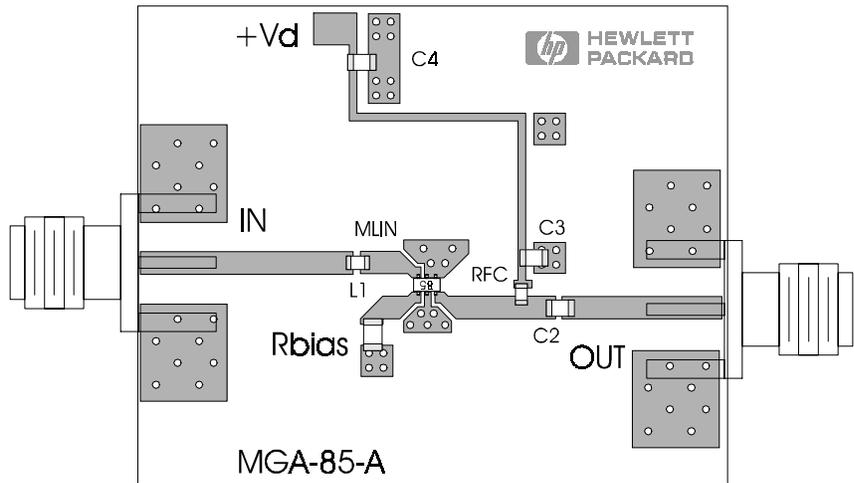


Figure 2. Assembled Evaluation Circuit.

depending on whether the bias-setting resistor R_b is used.

The only adjustment that may be needed is to fine-tune the input inductor L1 to achieve minimum NF. The values for L1 that are shown in Table 1 may vary slightly depending on the particular components used in the assembly.

Frequency (GHz)	L1 (nH)
0.8	22
0.9	18
1.5	8.2
1.9	5.6
2.4	2.7
5.1	0
5.8	0

Table 1. Values for L1. .

Notes Specific to 800-900 MHz

The values in Table 1 for inductor L1 provide the best single-element match to G_{opt} for the MGA-85-A circuit board for frequencies in the

800-900 MHz range. However, a single-element input circuit does not exactly match the G_{opt} of the MGA-85563 to 50 W. A slightly lower NF can be achieved by adding an additional matching element. Refer to the Application Note/Data Sheet for the MGA-85563 for more information.

Notes on Pin 4 and the use of R_b

The interaction between the internal circuit of the RFIC and any reactive elements connected to Pin 4 (R_{bias}) may create a resonant dip in the gain response. For example, bypassing Pin 4 to the ground pad for Pin 5 will cause a resonance near 1.2 GHz. For this reason, the R_{bias} connection to the MGA-85563 is normally left un-

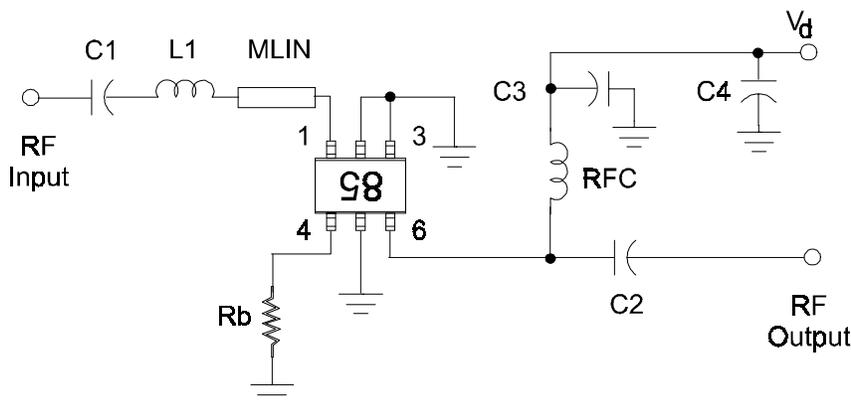


Figure 3. Schematic Diagram of MGA-85563 Amplifier Circuit.

bypassed unless the use of remote programming of the device current is desired. Setting the current of the RFIC remotely may be useful for the purpose of implementing real-time control of the amplifier's dynamic range. For applications in which the device current is to be controlled remotely, a small resistor can be added in series with the R_{bias} pin. The addition of this resistor will de-Q the connection to the external circuit and eliminate resonances.

If left unconnected, the reactance of the large PCB pad that is provided for Pin 4 on the MGA-85-A circuit board will interact with the MGA-85563 and cause a resonance at approximately 5.5 GHz. This will not affect use at lower frequencies. This resonance is eliminated if a resistor is added from Pin 4 to ground to take advantage of the adjustable current feature of the MGA-85563.

Notes Specific to 5.7 GHz

If the board is to be used at frequencies near 5-6 GHz without a bias-setting resistor, it is recommended that the PCB pad for Pin 4 be cut near the package pin as shown in Figure 4. This cut minimizes the pad reactance and eliminates the 5.5 GHz resonance mentioned in the previous section.

A Final Note on Performance

Actual performance of the MGA-85563 RFIC mounted on the MGA-85-A demonstration board may not exactly match data sheet specifications. The board material, passive components, and connectors all introduce losses and parasitics that may degrade device performance, especially at higher frequencies. Some variation

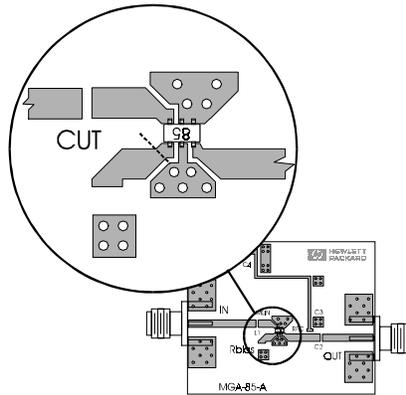


Figure 4. Pad cut for 5.7 GHz.

in measured results is also to be expected as a result of the normal manufacturing distribution of products.

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